# Radiolabeling Human Peripheral Blood Stem Cells for Positron Emission Tomography (PET) Imaging in Young Rhesus Monkeys.

**Journal:** PLoS One

**Publication Year:** 2013

**Authors:** Alice F Tarantal, C Chang I Lee, David L Kukis, Simon R Cherry

**PubMed link:** 24098579

**Funding Grants:** In Vivo Imaging for the Detection and Quantitation of Transplanted Stem/Progenitor Cells in Nonhuman Primates, In Utero Model to Assess the Fate of Transplanted Human Cells for Translational Research and Pediatric Therapies, UC Davis Translational Human Embryonic Stem Cell Shared Research Facility

**Public Summary:**
These studies focused on a new ways to label stem and progenitor cells for positron emission tomography (PET) imaging. Various assays were performed to develop the labeling conditions and to test the efficiency of labeling using peripheral blood stem cells. Once the conditions were determined this new technique was assessed post-transplant. Studies showed that this new radiolabeling method was able to identify engrafted cells.

**Scientific Abstract:**
These studies focused on a new radiolabeling technique with copper (64Cu) and zirconium (89Zr) for positron emission tomography (PET) imaging using a CD45 antibody. Synthesis of 64Cu-CD45 and 89Zr-CD45 immunoconjugates was performed and the evaluation of the potential toxicity of radiolabeling human peripheral blood stem cells (hPBSC) was assessed in vitro (viability, population doubling times, colony forming units). hPBSC viability was maintained as the dose of 64Cu-TETA-CD45 increased from 0 (92%) to 160 microCi/mL (76%, p>0.05). Radiolabeling efficiency was not significantly increased with concentrations of 64Cu-TETA-CD45 >20 microCi/mL (p>0.50). Toxicity affecting both growth and colony formation was observed with hPBSC radiolabeled with >/=40 microCi/mL (p<0.05). For 89Zr, there were no significant differences in viability (p>0.05), and a trend towards increased radiolabeling efficiency was noted as the dose of 89Zr-Df-CD45 increased, with a greater level of radiolabeling with 160 microCi/mL compared to 0-40 microCi/mL (p<0.05). A greater than 2,000 fold-increase in the level of 89Zr-Df-CD45 labeling efficiency was observed when compared to 64Cu-TETA-CD45. Similar to 64Cu-TETA-CD45, toxicity was noted when hPBSC were radiolabeled with >/=40 microCi/mL (p<0.05) (growth, colony formation). Taken together, 20 microCi/mL resulted in the highest level of radiolabeling efficiency without altering cell function. Young rhesus monkeys that had been transplanted prenatally with 25x106 hPBSC expressing firefly luciferase were assessed with bioluminescence imaging (BLI), then 0.3 mCi of 89Zr-Df-CD45, which showed the best radiolabeling efficiency, was injected intravenously for PET imaging. Results suggest that 89Zr-Df-CD45 was able to identify engrafted hPBSC in the same locations identified by BLI, although the background was high.